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ABSTRACT

This report was drawn from the 1996 National Assessment of Educational Progress (NAEP) and describes the science performance of eighth grade students in North Carolina. It compares results for various groups of students within that population and examines the results for individual demographic groups as well as individual background questions. The 1996 NAEP science framework is structured according to a matrix that consists of the fields of earth science, physical science, and life science crossed with processes of knowing and doing science such as conceptual understanding, scientific investigation, and practical reasoning. This NAEP 1996 Science State Report for North Carolina consists of sections that provide information on what was assessed, who was sampled, and how the results are reported; the distribution of science scale score results for eighth grade students in North Carolina; student results of the hands-on tasks; and contextual information about school characteristics, instruction, and home support for science in North Carolina. (DDR)

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The Nation's Report Card 1996

Science Assessment

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1996 NAEP Report *for North Carolina*

Eighth Grade Science

Public Schools of North Carolina
State Board of Education . Jay Robinson, Chairman
Department of Public Instruction . Michael E. Ward, State Superintendent
Testing/Accountability Services
Raleigh, North Carolina 27601-2825

Published May 1997

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The

1996

National

Assessment

Of

Educational Progress

NAEP Grade 8 Science

Adapted from the *1996 NAEP Science Report Card for the Nation and the States*

Testing Section
Division of Accountability Services
May 12, 1997

1996 NAEP Science Report for North Carolina Grade 8

Adapted from the NAEP 1996 Science Report Card for the Nation and the States

What is NAEP?

- The National Assessment of Educational Progress (NAEP) is a congressionally mandated survey of the educational achievement of American students. Since 1969, NAEP has conducted periodic assessments in reading, mathematics, science, writing, history, geography, and other fields.

- In 1990, NAEP began a voluntary state-by-state assessment program with eighth-grade mathematics. The 1996 NAEP mathematics assessments in grades 4 and 8 continued the state-level components conducted in 1990 (grade 8 only) and 1992 (grades 4 and 8). In 1994, fourth-grade reading was also assessed on a state-by-state basis.

- In 1996, 44 jurisdictions (including North Carolina), along with GUAM, the District of Columbia, and two special Defense Department schools participated in the state-by-state assessment program in science at grade 8.

- The NAEP 1996 science assessment continues the mandate to evaluate and report the educational progress of students nationally at grades 4, 8, and 12. While science was assessed in the three grades, state-level results are available only for grade 8.

- North Carolina, believing in the importance of comparing its students' performance to national standards, has voluntarily participated in all NAEP state-by-state assessments.

- As the nation's survey of students' educational progress, NAEP has become an important resource for obtaining information on what students know and are able to do. The science assessment measures the content and skills described in the science framework for the 1996 NAEP.

- Although NAEP assesses the performance of both public and nonpublic school students, this report focuses on the performance of public school students only.

1996 NAEP Science Assessment at Grade 8

- The NAEP 1996 science assessment measured the NAEP science framework which has two organizing concepts: (1) to make scientific information useful and (2) to use the tools, procedures, and reasoning processes of science to develop an understanding of the natural world. The NAEP science assessment uses several strategies to measure the framework:
  - Multiple-choice questions that assess students' knowledge of important facts and concepts that probe analytical reasoning skills;
  - Constructed-response questions that explore students' abilities to explain, integrate, apply, reason about, plan, design, evaluate, and communicate scientific information; and
  - Hands-on tasks that probe students' abilities to use materials to make observations, perform investigations, evaluate experimental results, and apply problem-solving skills.
- The framework at grade 8 divides science into three major fields: earth, physical, and life. In addition, the framework defines the characteristic elements of knowing and doing science; conceptual understanding, scientific investigation, and practical reasoning. The assessment contains questions that measure one element of knowing and in one of the fields of science, for instance scientific investigation in earth science.
- The assessment consisted of both multiple-choice, constructed-response (both short and extended answers) questions, and hands on activities.
- The NAEP science assessment was developed by the Educational Testing Service under a cooperative agreement with the National Center for Education Statistics.

Reporting of NAEP Science Assessment

- Performance is reported on a proficiency scale and by national achievement levels, however, the achievement levels were not available at the time of the public release of the scores.
- The proficiency scale ranges from 0 to 300 for grade 8 with students scoring at the 10th percentile achieving a score of 105 to 192 for those scoring at the 90th percentile.
- Grade 8 performance on the 1996 NAEP science assessment is reported by state or jurisdiction, regional, and national averages. In addition, performance is reported on the basis of demographic subgroups.

Major Findings for the Regions and States[2]

NAEP data can be used to compare student performance of fourth-, eighth-, and twelfth-grade students attending schools in four different regions — Northeast, Southeast, Central and West — and state-level results for eighth-grade students.

- For all three grades, students in the Central region had higher average scores than students in the Southeast region.
- In 19 of the 44 participating jurisdictions,[3] the average scale score for public school eighth graders was higher than the national average, while 14 jurisdictions performed below this average. The remaining 11 jurisdictions performed at or around the national average.

Summary of Jurisdiction Performance Relative to the Nation for Grade 8 Public Schools

THE NATION'S REPORT CARD naep

Performed Above the National Average	Performed At or Around the National Average	Performed Below the National Average
Alaska ‡	Arizona	Alabama
Colorado	Kentucky	Arkansas ‡
Connecticut	Maryland ‡	California
DDESS	Missouri	Delaware
DoDDS	New York ‡	District of Columbia
Indiana	North Carolina	Florida
Iowa ‡	Rhode Island	Georgia
Maine	Texas	Guam
Massachusetts	Virginia	Hawaii
Michigan ‡	Washington	Louisiana
Minnesota	West Virginia	Mississippi
Montana ‡		New Mexico
Nebraska		South Carolina ‡
North Dakota		Tennessee
Oregon		
Utah		
Vermont ‡		
Wisconsin ‡		
Wyoming		

‡ Indicates that the jurisdiction did not satisfy one or more of the guidelines for public school participation rates (see Appendix A).

DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools

DoDDS: Department of Defense Dependents Schools (Overseas)

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Science Assessment.

[2] In all discussions of differences in academic performance between subgroups, only statistically significant differences are reported. Such differences are unlikely to be due to chance factors.

[3] Several states participated but failed to meet established participation guidelines for reporting results. See Appendix A for more complete information of jurisdictions' participation rates.

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Table 2.2

Science Scale Score Results by Jurisdiction for Grade 8 Public Schools

THE NATION'S REPORT CARD

	MEAN	10th	25th	50th	75th	90th
Performed Above the National Average						
Maine	163	128	145	164	182	196
North Dakota	162	127	146	164	181	195
Montana ‡	162	127	146	164	180	194
Wisconsin ‡	160	120	141	162	181	196
Minnesota	159	121	140	161	179	194
Iowa ‡	158	121	140	160	178	193
Wyoming	158	122	140	158	176	192
Nebraska	157	118	139	159	178	193
Vermont ‡	157	119	139	158	177	193
Massachusetts	157	114	137	160	179	196
Utah	156	120	138	158	175	190
Connecticut	155	110	135	158	179	195
DoDDS	155	118	137	157	175	190
Oregon	155	115	136	157	176	192
Colorado	155	114	136	157	176	192
Michigan ‡	153	111	133	156	176	192
Indiana	153	115	133	155	174	190
DDESS	153	117	135	153	172	188
Alaska ‡	153	111	133	156	175	192
Performed At or Around the National Average						
Missouri	151	109	132	154	172	189
Washington	150	108	130	152	172	189
Virginia	149	106	128	151	172	190
Rhode Island	149	108	129	150	171	189
Nation	**148**	**102**	**126**	**151**	**172**	**191**
Kentucky	147	107	127	149	168	185
West Virginia	147	112	129	148	166	182
North Carolina	147	104	125	148	169	187
New York ‡	146	96	122	149	172	190
Maryland ‡	145	99	123	148	170	189
Texas	145	102	123	147	169	185
Arizona	145	102	124	147	168	184
Performed Below the National Average						
Arkansas ‡	144	100	123	147	168	184
Tennessee	143	98	121	146	167	185
Florida	142	98	120	144	166	184
Georgia	142	97	120	143	166	184
Delaware	142	96	121	144	165	183
New Mexico	141	99	119	142	164	182
Alabama	139	95	117	140	163	180
South Carolina ‡	139	96	116	139	161	180
California	138	89	115	140	164	183
Hawaii	135	90	114	137	158	176
Mississippi	133	91	111	134	155	174
Louisiana	132	86	110	135	157	175
Guam	120	74	96	121	146	165
District of Columbia	113	71	90	112	135	156

‡ Indicates that the jurisdiction did not satisfy one or more of the guidelines for school participation rates (see Appendix A).

NAEP science scales were developed independently for each grade assessed; therefore, results are not comparable across grades. Scale scores range from 0 to 300.

DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools

DoDDS: Department of Defense Dependents Schools (Overseas)

National results are based on the national assessment sample of public schools, not on aggregated state assessment program samples (see Appendix A).

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Science Assessment.

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Assessment Standards in North Carolina

- In 1989, the State Board of Education adopted a revised *Standard Course of Study* in mathematics for grades K-8. In 1992, the language arts curriculum was revised to focus on thinking skills.

- In 1989, the science curriculum was revised. The science curriculum was again revised in 1995 to reflect current trends in the area of science which focus more on hands-on science and process skills. The current science curriculum in North Carolina emphasizes the nature of science, scientific process skills, manipulative skills, scientific attitudes, and scientific concepts. The revised curriculum was developed in collaboration with educators from across the state and is aligned with national standards in science.

- Beginning in 1992-93, the North Carolina End-of-Grade Tests were implemented in grades 3 through 8. End-of-grade tests measure reading and mathematics based on the revised curricular areas. Although science is no longer assessed in the elementary and middle grades as a component of the statewide assessment program, science assessment instruments in grades 3-8 are available to local school districts as an option. The optional science tests were developed to reflect the revisions in the curriculum and current trends in science.

- In 1996, North Carolina students at grade 8 had several advantages over North Carolina students who were tested on earlier NAEP assessments:

    1. Multiple years of instruction focusing on the competencies described in the revised *Standard Course of Study* which emphasizes higher order thinking skills and problem solving;

    2. Multiple years of taking the North Carolina assessments which measure curriculum implementation using a variety of strategies to assess what students know and are able to do; and

    3. Teachers who are more familiar with the revised curriculum and assessment standards and have adjusted their instructional strategies to reflect a focus on problem solving and higher order thinking skills with a greater emphasis on students demonstrating what they know and are able to do.

- The overall curriculum and assessment package in grades 3 through 8 provides for a rigorous academic experience for North Carolina students.

Performance of North Carolina Students on NAEP Grade 8 Science

- Results from the NAEP 1996 state science assessment represent a current depiction of the science performance of eighth-grade students in North Carolina, the Southeast region, and the nation.

- North Carolina's performance in science in 1996 was slightly below (one point) the nation in grade 8 science. **The average performance of North Carolina students in eighth-grade science in 1996 was 147 compared to 148 for the nation**.

- North Carolina is one of 11 states of the 44 jurisdictions that performed at or around the national average. Of the participating jurisdiction, 19 scored above the national average and 14 scored below the national average.

- The average performance of North Carolina (147) students on the NAEP science assessment exceeded that of the Southeast Region (141) by six scale score points.

- Of the 44 jurisdictions participating in the NAEP assessment in science at the eighth grade, North Carolina scored as well as or better than 20 of them. North Carolina tied with Kentucky and West Virginia with a rank of 24th from the top.

Performance of Subgroups at Grade 8 in Science

- ***Gender.*** On the average, male students scored slightly higher (149) than female students (148) at the national level.

- In North Carolina, on the average, male students scored significantly higher (149) than female students (145). The average score for North Carolina males was equal to their national counterparts while female students achieved a scale score lower than that of their national counterparts.

- ***Race/Ethnicity***. The national average performance of White students (159) in science at grade 8 was higher than that of Asian students (150), American Indian students (148), Hispanic students (127), and that of Black students (120).

- The average performance of White students (157) in North Carolina is higher than other ethnic categories (American Indian 136, Black 126, and Hispanic 123) of students in North Carolina but lower than their national counterparts. (Sample sizes for Asian students were insufficient to make reliable estimates regarding student performance.) The performance of Black students in North Carolina (126) was the only ethnic category in which the average performance was greater than that of the national average for Black students (120).

- ***Parents' Education Level***. In general, increasing levels of parental education are associated with higher average science performance in North Carolina and the nation.

- Except in the category of *Parents Graduated from College,* where the average performance of North Carolina's students (158) is higher than their counterparts in the nation (157), the average performance of all other categories *of Parents' Education Levels* (*Did Not Finish High School 126, Graduated from High School 134, Some Education After High School 150),* of North Carolina students is lower than their counterparts at the national level.

It is possible to illustrate the level of achievement of students with a given scale score by identifying questions likely to be answered correctly by students with that scale score, a process known as "mapping." The position of the question on the scale represents the scale score attained by students who had at least a 65 percent probability of reaching a given score level on a constructed-response question or at least a 74 percent probability of correctly answering a multiple-choice question. Mapping questions onto the NAEP science scales can be used to illustrate the range of achievement of students *at or near* selected percentiles. For example, eighth graders at or near the 50th percentile were likely to correctly identify the source of acid rain. Put slightly differently, this question was answered correctly by at least 74 of every 100 students scoring at or above the 150 scale-score level.

Sample Questions At or Near Selected Percentiles

THE NATION'S REPORT CARD

Grade 4

10th	Identify items that conduct electricity. (105)
25th	Read the level of a liquid in a graduated cylinder. (129)
50th	Infer the function of animal teeth from diagrams showing their structure. (152)
75th	Explain the impact of fish death on an ecosystem. (173)
90th	Explain why Earth never runs out of water. (192)

Grade 8

10th	Find typical yearly rainfall from a graph. (104)
25th	Explain the impact of fish death on an ecosystem. (127)
50th	Identify the source of acid rain. (150)
75th	Understand the location of earthquakes. (172)
90th	Explain why lightning is seen before thunder is heard. (194)

Grade 12

10th	Determine which planet has the longest year given data. (99)
25th	Describe how to avoid electric shocks in the home. (125)
50th	Identify what happens when a magnet is placed inside a coil. (150)
75th	Understand which evidence supports continental drift theory. (177)
90th	Understand structure and function of cell parts. (197)

The value in parentheses represents the scale score attained by students who had a 65 percent probability of reaching a given level on a constructed-response question or a 74 percent probability of correctly answering a 4-option multiple-choice question.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Science Assessment.

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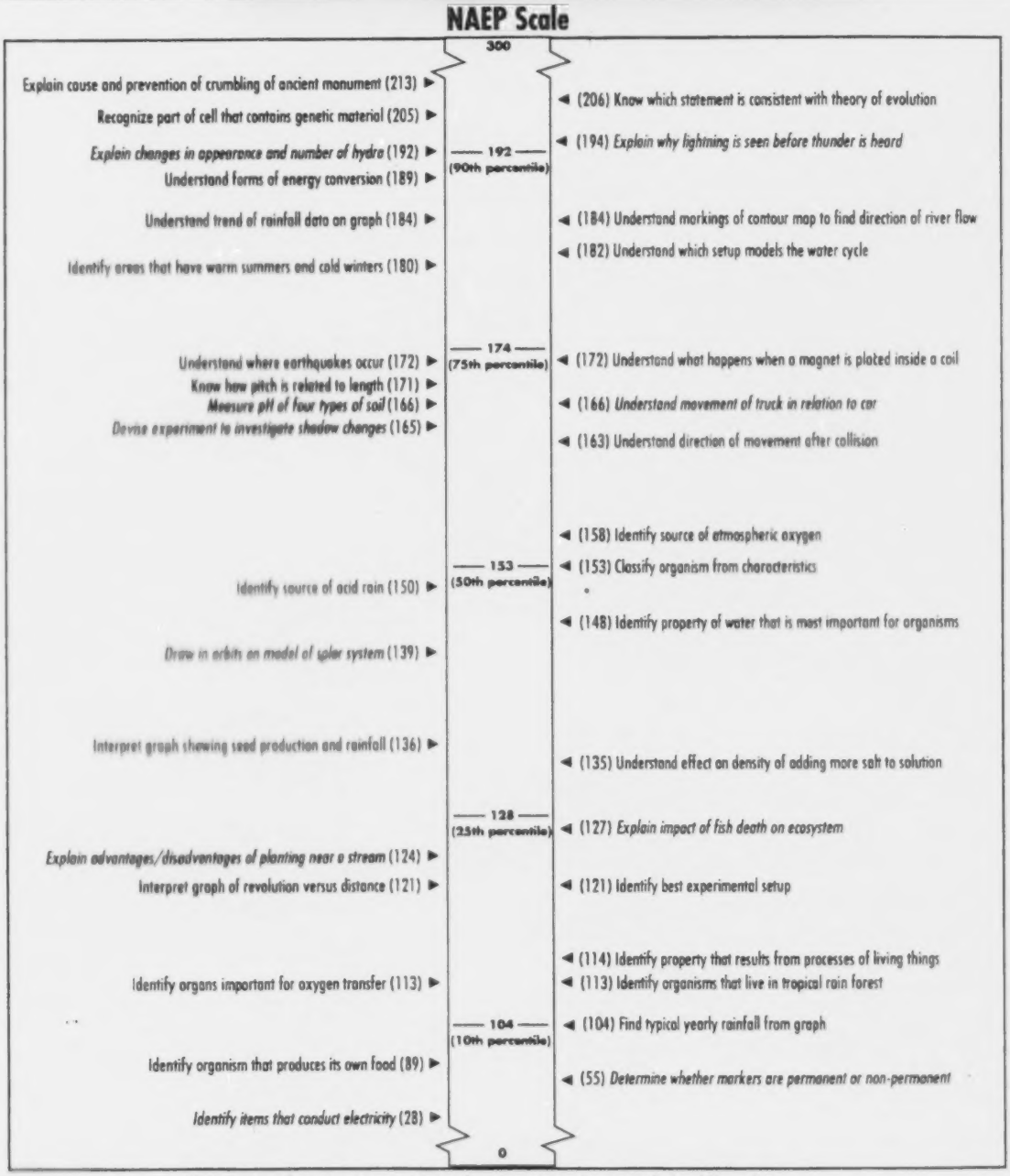
Figure 1.3 Map of Selected Questions on the NAEP Science Scale for Grade 8


NAEP Scale
300
Explain cause and prevention of crumbling of ancient monument (213)
Recognize part of cell that contains genetic material (205)
Explain changes in appearance and number of hydra (192)
Understand forms of energy conversion (189)
Understand trend of rainfall data on graph (184)
Identify areas that have warm summers and cold winters (180)
Understand where earthquakes occur (172)
Know how pitch is related to length (171)
Measure pH of four types of soil (166)
Devise experiment to investigate shadow changes (165)
Identify source of acid rain (150)
Draw in orbits on model of solar system (139)
Interpret graph showing seed production and rainfall (136)
Explain advantages/disadvantages of planting near a stream (124)
Interpret graph of revolution versus distance (121)
Identify organs important for oxygen transfer (113)
Identify organism that produces its own food (89)
Identify items that conduct electricity (28)
192 (90th percentile)
174 (75th percentile)
153 (50th percentile)
128 (25th percentile)
104 (10th percentile)
0
(206) Know which statement is consistent with theory of evolution
(194) Explain why lightning is seen before thunder is heard
(184) Understand markings of contour map to find direction of river flow
(182) Understand which setup models the water cycle
(172) Understand what happens when a magnet is placed inside a coil
(166) Understand movement of truck in relation to car
(163) Understand direction of movement after collision
(158) Identify source of atmospheric oxygen
(153) Classify organism from characteristics
(148) Identify property of water that is most important for organisms
(135) Understand effect on density of adding more salt to solution
(127) Explain impact of fish death on ecosystem
(121) Identify best experimental setup
(114) Identify property that results from processes of living things
(113) Identify organisms that live in tropical rain forest
(104) Find typical yearly rainfall from graph
(55) Determine whether markers are permanent or non-permanent

NOTE: Position of questions is approximate and an appropriate scale range is displayed for grade 8.
Italic type indicates a constructed-response question. Regular type denotes a multiple-choice question.

Each grade 8 science question was mapped onto the NAEP 0-to-300 science scale. The position of the question on the scale represents the scale score attained by students who had a 65 percent probability of reaching a given score level on a constructed-response question or a 74 percent probability of correctly answering a 4-option multiple-choice question. Only selected questions are presented. Percentiles of scale score distribution are referenced on the map.

SOURCE: National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 Science Assessment.

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Figure 1.6 NAEP 1996 Science Sample Questions for Grade 8

THE NATION'S REPORT CARD naep

A group of students took potato salad made with mayonnaise to a picnic on a very hot day. Explain how eating the potato salad could cause food poisoning.

When mayonnaise gets to hot it starts growing dorsonious bactrias which can give you food poisoning

Describe something that could be done to the potato salad to prevent the people who eat it from getting food poisoning.

It can be kept in a cooler and stay cool until they want to eat it. then they should put it back in the cooler.

This short constructed-response question measures Life Science and Practical Reasoning. Students' responses were scored using a three-level scoring guide that allowed for partial credit. The sample student response received the highest score, **Complete.** To receive a score of **Complete,** a student's response needed to explain the cause of food poisoning and describe a method of preventing it.

Percentages of Eighth Graders Receiving Complete and Partial Scores	
Complete	**10%**
Partial	**61%**

Imagine that you could put popcorn kernels into an airtight popcorn popper and measure the mass of the popper with the kernels. After the popcorn has popped, the mass of the popper and the popcorn will be

(A) less than the original mass because popped corn is less dense than the kernels are

(B) equal to the original mass because the container is airtight

(C) greater than the original mass because the volume of the popped corn is greater than that of the kernels.

(D) impossible to determine accurately without weighing each piece of popcorn immediately

This multiple-choice question measures Physical Science and Conceptual Understanding and was scored as either correct or incorrect.

The correct answer is B.

Percentage of Eighth Graders Answering Correctly
26%

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Figure 1.6 (continued) NAEP 1996 Science Sample Questions for Grade 8

THE NATION'S REPORT CARD

This extended constructed-response question measures Earth Science and Scientific Investigation. Students' responses were scored using a four-level scoring guide. The first sample student response received the highest score, **Complete.** To receive a score of **Complete,** a student's response needed to predict the relative temperature of the sand and water at noon and explain the answer. The students response also needed to give a satisfactory explanation of why the prediction might be wrong.

The question refers to an experiment your teacher asks you to perform to compare the heating rate of soil with that of water. To do this, you are given the following materials: 2 heat lamps, 2 bins, 2 thermometers, 1 sample of soil, 1 sample of water, 1 timer.

You are instructed to heat a sample of soil and a sample of water with heat lamps, measuring the temperature of each sample once a minute for 8 minutes.

Suppose that the experiment yielded the results shown in the table below.

Time (min)	0	1	2	3	4	5	6	7	8
Soil temp (°C)	20	21	22.5	24	26	27.5	29.5	30.5	32
Water temp (°C)	20	21.5	23	23.5	24	25.5	26	27.5	28.5

At a beach that has white sand, you measure the temperature of the sand and the temperature of the seawater at 9:00 a.m. You find that both have a temperature of 16°C. If it is clear and sunny all morning, what do the data from the experiment predict about the temperature of the white sand compared to the temperature of the seawater at noon?

the sand will be hotter.

Explain your answer.

You can tell from the experiment that the soil is getting hotter faster than the water - So I believe the same thing will happen at the beach.

Explain why the prediction based on the data might be wrong.

because there are other factor to consider such as the ocean is constantly moving and thee ocean has salt in it and the ocean is heated by the sun and not a lamp.

Percentages of Eighth Graders Receiving Complete, Essential, and Partial Scores	
Complete	6%
Essential	6%
Partial	31%

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Figure 1.6 (continued) NAEP 1996 Science Sample Questions for Grade 8

THE NATION'S REPORT CARD

The question refers to an experiment your teacher asks you to perform to compare the heating rate of soil with that of water. To do this, you are given the following materials: 2 heat lamps, 2 bins, 2 thermometers, 1 sample of soil, 1 sample of water, 1 timer.

You are instructed to heat a sample of soil and a sample of water with heat lamps, measuring the temperature of each sample once a minute for 8 minutes.

Suppose that the experiment yielded the results shown in the table below.

Time (min)	0	1	2	3	4	5	6	7	8
Soil temp (°C)	20	21	22.5	24	26	27.5	29.5	30.5	32
Water temp (°C)	20	21.5	23	23.5	24	25.5	26	27.5	28.5

At a beach that has white sand, you measure the temperature of the sand and the temperature of the seawater at 9:00 a.m. You find that both have a temperature of 16°C. If it is clear and sunny all morning, what do the data from the experiment predict about the temperature of the white sand compared to the temperature of the seawater at noon?

It will increase more than that of the water

Explain your answer.

In the first experiment, the soil heats up faster. (Also, water has the highest Specific heat of any substance, which will take longest to heat up and cool down

Explain why the prediction based on the data might be wrong.

I don't see why it would be wrong

The second sample student response received a score of **Essential.** To receive a score of **Essential,** a student's response needed to predict the relative temperature of the sand and water at noon and explain the answer. The response did not explain why the prediction might be wrong.

Percentages of Eighth Graders Receiving Complete, Essential, and Partial Scores	
Complete	**6%**
Essential	**6%**
Partial	**31%**

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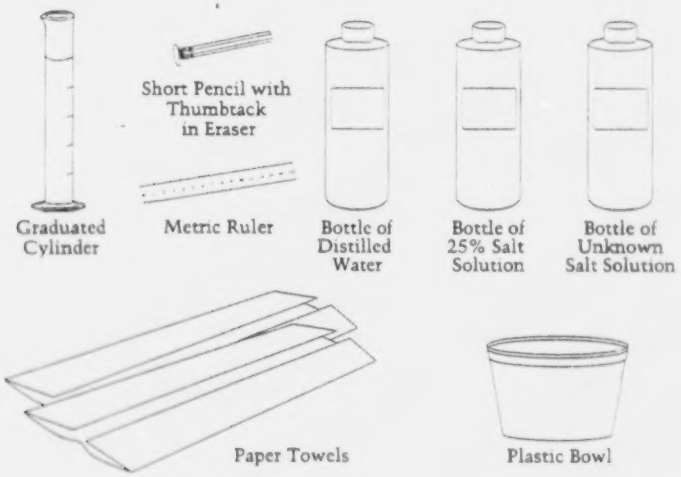
Grade 8: Task Summaries and Sample Questions

SALT SOLUTIONS

Estimating the Salt Concentration of an Unknown Salt Solution Using the "Floating Pencil Test"

For this task, you have been given a kit that contains materials that you will use to perform an investigation during the next 30 minutes. Please open your kit now and use the following diagram to check that all of the materials in the diagram are included in your kit. If any materials are missing, raise your hand and the administrator will provide you with the materials that you need.



An instrument constructed from a pencil and thumbtack served as a hydrometer in this task. Students were asked to observe, measure, and compare the lengths of a portion of pencil, marked with calibrations for ease of measurement, that floated above the surface in distilled water and in a 25% salt solution. Based on these observations, the students were asked to predict how the addition of more salt to the salt solution would affect the floating pencil. Students then measured the length of the pencil that floated above the surface of a solution of unknown salt concentration and used the results of their previous observations to estimate the salt concentration of the unknown solution. The task assessed students' ability to make simple observations, measure length using a ruler, apply observations to an unknown, draw a graph, interpolate from graphical data, and make a generalized inference from observations. The task also assessed students' understanding of the value of performing multiple trials of the same procedure.

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Figure 3.3 Sample Questions from the Grade 8 Hands-On Task: Salt Solution

Measurement: Students' responses were scored using a four-level scoring guide. The sample student response received the highest score, **Complete** because the three sets of measurements agreed within tolerance and were in the correct relative order.

Percentages of Eighth Graders Receiving the Following Scores		
Complete	**Essential**	**Partial**
42%	**16%**	**21%**

Average: Students' responses were scored using a three-level scoring guide. The sample student response received a score of **Complete** because the three averages were correctly calculated.

Percentages of Eighth Graders Receiving the Following Scores	
Complete	**Partial**
57%	**22%**

Graph: Students' responses were scored using a three-level scoring guide. The sample student response received a score of **Complete** because the two data points were plotted correctly.

Percentages of Eighth Graders Receiving the Following Scores	
Complete	**Partial**
28%	**19%**

Interpolation: Students' responses were scored using a four-level scoring guide. The sample student response received a score of **Complete** because the concentration of salt in the unknown solution was interpolated correctly and a satisfactory explanation was given.

Percentages of Eighth Graders Receiving the Following Scores		
Complete	**Essential**	**Partial**
20%	**8%**	**16%**

Now take the pencil out of the water and dry it with a paper towel. Use the ruler to measure the length of the pencil that was above the water. Record the length in Table 1 below under **Measurement 1.**

TABLE 1

Length of Pencil Above Water Surface (cm)

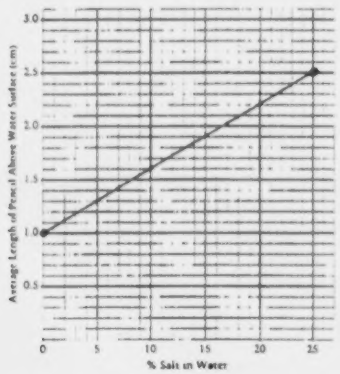
Type of Solution	Measurement 1	Measurement 2	Average
Distilled Water	1 cm	1 cm	1 cm
Salt Solution	2½ cm	2½ cm	2½ cm
Unknown Salt Solution	2 cm	2 cm	2 cm

Now place the pencil back in the distilled water and repeat steps 2 and 3. Record your measurement in Table 1 under **Measurement 2.**

Calculate the average of Measurements 1 and 2 and record the result in the data table.

(You can calculate the average by adding Measurement 1 + Measurement 2 and then dividing by two.)

On the graph below, plot the average values you obtained for the distilled water and the 25% salt solution. Draw a straight line between the two data points. Assume that this line represents the relationship between the length of pencil that is above the water surface and the concentration of salt in the water.



Based on the graph that you plotted, what is the salt concentration of the unknown solution? about 16%

Explain how you determined your answer.

With the line connecting the distilled water and the salt solution I measured 2 cm. The measurement connects to the line at about 16% so the unknown solution is about 16%

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Figure 3.3 (continued)

Sample Questions from the Grade 8 Hands-On Task: Salt Solution

Now take the pencil out of the water and dry it with a paper towel. Use the ruler to measure the length of the pencil that was above the water. Record the length in Table 1 below under **Measurement 1**.

TABLE 1

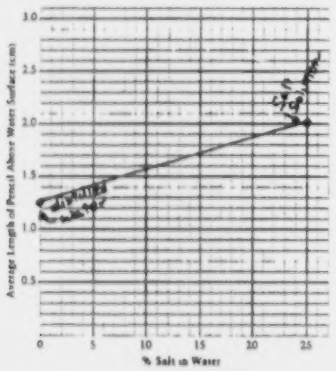
Type of Solution	Length of Pencil Above Water Surface (cm) Measurement 1	Measurement 2	Average
Distilled Water	1 metric cm	½ metric cm	1½ metric cm
Salt Solution	2 metric cm	2 metric cm	2 metric cm
Unknown Salt Solution	1½ metric cm	1½ metric cm	2 2/2 metric cm

Now place the pencil back in the distilled water and repeat steps 2 and 3. Record your measurement in Table 1 under **Measurement 2**.

Calculate the average of Measurements 1 and 2 and record the result in the data table.

(You can calculate the average by adding Measurement 1 + Measurement 2 and then dividing by two.)

On the graph below, plot the average values you obtained for the distilled water and the 25% salt solution. Draw a straight line between the two data points. Assume that this line represents the relationship between the length of pencil that is above the water surface and the concentration of salt in the water.



Based on the graph that you plotted, what is the salt concentration of the unknown solution? About 12%

Explain how you determined your answer.

Because it right in half between the two

Measurement: Students' responses were scored using a four-level scoring guide. The sample student response received a score of **Partial** because only two sets of measurements agreed within tolerance.

Percentages of Eighth Graders Receiving the Following Scores		
Complete	**Essential**	**Partial**
42%	**16%**	**21%**

Average: Students' responses were scored using a three-level scoring guide. The sample student response received a score of **Partial** because only one average was correctly calculated.

Percentages of Eighth Graders Receiving the Following Scores	
Complete	**Partial**
57%	**22%**

Graph: Students' responses were scored according to a three-level scoring guide. The sample student response received a score of **Partial** because only one of the two data points was plotted correctly.

Percentages of Eighth Graders Receiving the Following Scores	
Complete	**Partial**
28%	**19%**

Interpolation: Students' responses were scored according to a four-level scoring guide. The sample student response received a score of **Incorrect** because the student did not give a response consistent with the data and the explanation was unsatisfactory.

Percentages of Eighth Graders Receiving the Following Scores		
Complete	**Essential**	**Partial**
20%	**8%**	**16%**

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